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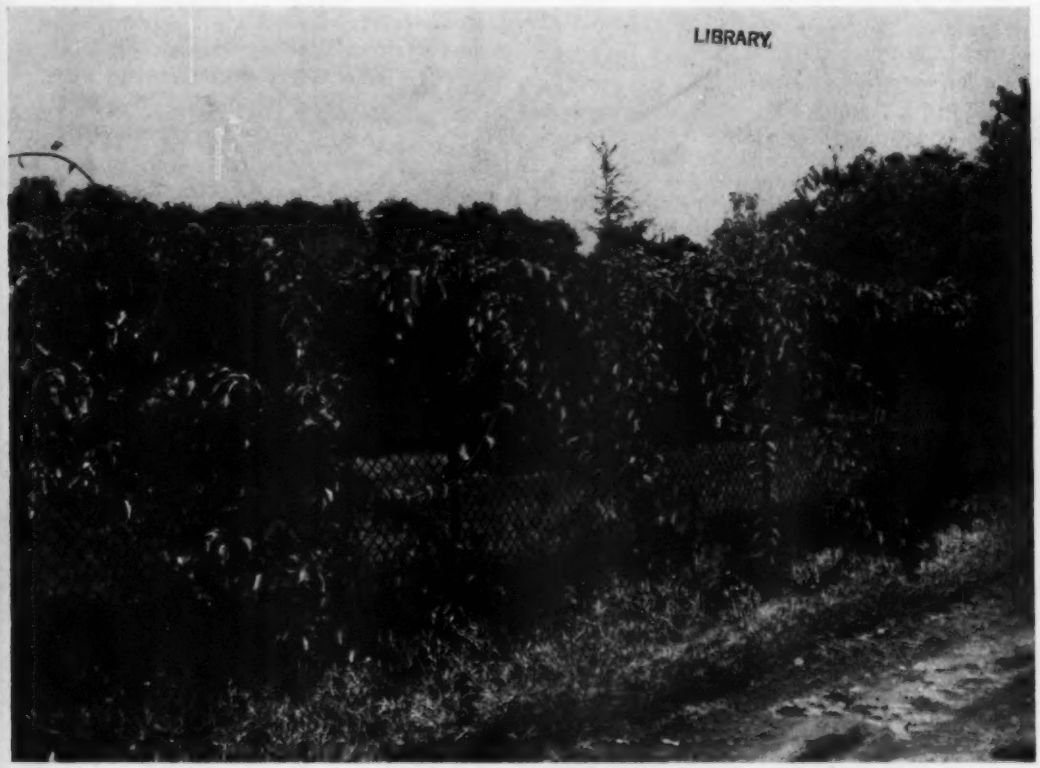

Actinidia arguta at the Arboretum

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Arboretum Activities

NEW PLANTINGS

The late winter and early spring of this year have been a period of considerable activity with respect to the setting out of new groups of plants. In the first place, the area devoted to the display of Glen Dale Azaleas, which were so much admired last May, has been further extended to include an appreciable series of color forms not hitherto exhibited at the Arboretum.

An even more ambitious undertaking has been the conversion of the Oak Row Nursery into an orderly planting of Rhododendrons and Azaleas. This was a rather extensive nursery in which for a number of years we have been testing out these plants prior to selecting the most worthy. The area is now being transformed into a series of beds and walks which, when completed, will have the advantage of continuing our so-called

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Actinidia at the Morris Arboretum

JOHN M. FOGG, JR.

The genus *Actinidia* contains about 35 species of deciduous twining shrubs or woody vines with alternate, simple leaves, many-stamened flowers and fleshy fruits. Although most of the species occur in China, the genus as a whole ranges from the Himalayas, Burma and Malaysia to eastern Siberia, Korea, Sakhalin and Japan. Several of the species are greatly valued in Asia because of their edible fruits and some half dozen have found their way into cultivation in this country, chiefly as ornamental vines.

Formerly placed in the Dilleniaceae, *Actinidia* is regarded by most botanists today as belonging, along with *Clematoclethra* and one or two other genera, to a family bearing its own name, the Actinidiaceae. Since the affinities of this family are with the Sterculia Family and the Tea Family which (includes not only Tea but such genera as *Franklinia, Stewartia* and *Camellia),* it is not surprising to find that the flowers of *Actinidia* are characterized by the presence of numerous showy stamens. In fact, it is the large crown of golden or purple stamens which imparts to the otherwise inconspicuous flowers of some species their showy quality.

Several of the Actinidias which are hardy in our area are robust climbers with attractive foliage and deserve to be more widely used for screening purposes or even as hedge plants. The leaves are generally large and heart-shaped and manifest considerable variation with respect to pubescence and color patterns.

The flowers of this genus are for the most part imperfect (unisexual) and the plants are generally dioecious, that is, male and female flowers occur on different individuals. This means, of course, that in order to insure the production of fruit one must have both staminate and carpellate plants, a situation familiar to all who grow hollies and other dioecious genera.

The fruit of *Actinidia* is a berry with greenish pulp and numerous small seeds. Two species in partciular, *A. chinensis* and *A. arguta,* have long been used in China for their edible fruits which have a pleasant acid taste.

Among the species cited by Rehder (1940) as being in cultivation in this country are: *A. chinensis* Planch., *A. callosa* Lindl., *A. melanandra* Franch., *A. Kolomikta* (Maxim. & Rupr.) Maxim., *A. polygama* (Sieb. & Zucc.) Miq., and *A. arguta* (Sieb & Zucc.) Miq. A half dozen others are mentioned as of possible interest to American growers. In 1952 Dr. Hui-Lin Li, Taxonomist of the Staff of the Morris Arboretum, published a comprehensive study of the genus which is recommended to those who desire to achieve a fuller understanding of this fascinating group of plants.

The following species are in cultivation at the Arboretum and the chief purpose of these notes is to call attention to their value as hardy and attractive climbers.

A. CHINENSIS. Chinese Actinidia. Yang-tao.

As indicated by its name, this species is a native of China where it is of widespread occurrence, particularly in the Yangtze valley. It is a vigorous climber, often attaining a height of 25 or 30 feet. The young branchlets and petioles are covered with prominent soft reddish or brownish hairs which give them a somewhat velvety appearance. The large heart-shaped

Fig. 16. *A. chinensis*

Fig. 17. *A. chinensis* at Lankenau Girls' School, Germantown, Philadelphia.

leaves are dark green above and whitish tomentose beneath with reddish to brownish hairs on the veins (See Fig. 16). A characteristic feature of the leaves is their prominently ciliate margins, which results from the prolongation beyond the edge of the leaf of many of the smaller veins.

The flowers of *A. chinensis* appear on the wood of the previous year and the creamy-white to yellowish corollas, about 1½ inches in diameter, are almost obscured by the conspicuous crown of bright yellow stamens. In bloom this is one of the most attractive members of the genus.

The fruit of this species is an ovoid to subglobose berry covered with short brownish hairs. It has long been cultivated in China where it is known as Yang-tao. E. H. Wilson (1913. v. 2, p. 32) states that the plant "produces excellent fruit of a roundish or oval shape, 1 inch to 2½ inches long, with a thin, brown, often hairy skin covering a luscious green flesh." He adds, "In 1900 I had the pleasure of introducing this fruit to the foreign residents of Ichang, with whom it found immediate favour, and is now known throughout the Yangste Valley as the "Ichang Gooseberry." I also was privileged to introduce it into European cultivation and it fruited in England for the first time in 1911."

David Fairchild (1947. p. 203) speaks with appreciation of the "hairy fruits that reminded us of giant English gooseberries." Fairchild (1927) has also described an interesting hybrid which he made between this species and *A. arguta*. This hybrid was later designated as × *A. Fairchildii* by Rehder (1939).

The single plant of *A. chinensis* growing in the Arboretum is a young one, probably not more than five or six years old, and has not yet produced flowers. In the spring its new growing tips are extremely attractive with their covering of reddish velvety pubescence.

A very handsome plant of this species is to be found on the grounds of the Lankenau Girls' School on School Lane in Germantown. Here the plant covers a large arbor and the stems are 4 or 5 inches in diameter at the base. (See Fig. 17)

A. KOLOMIKTA. Kolomikta Vine

A native of China, Manchuria and Japan. In contrast to the foregoing, this species is a rather weak climber with a reported maximum height of 8 to 10 feet. With us it appears more inclined to remain a low sprawling shrub.

The large, thin, heart-shaped leaves (See Fig. 18) are frequently pubescent on the veins, although they lack the whitish tomentum and reddish hairs which characterize *A. chinensis*.

Fig. 18. *A. Kolomikta*

Fig. 19. *A. arguta.* Leaves of male plant.

Several writers have called attention to the rather striking sexual dimorphism which occurs in the foliage of various species of *Actinidia.* This is well seen in *A. Kolomikta,* in which the leaves of the male plants are generally more variegated, with white or pink blotches, than are those of the female. The same apparently holds for *A. polygama.*

The flowers of *A. Kolomikta* are white, about ½ inch in diameter, and somewhat fragrant. They are said to be strictly unisexual and the plants themselves are diocecious. The oblong berries are green or yellow when mature and are reputed to be sweet though insipid. Our material is not yet sufficiently mature to have produced fruit.

A. Kolomikta has frequently been confused with the Silver Vine, *A. polygama.* However, as pointed out by Bailey, Rehder and others, the pith of *A. Kolomikta* is lamellated (chambered) and brownish in color, whereas that of *A. polygama* is solid and white.

A. ARGUTA. Bower Actinidia. Japanese Kokuwa.

A wide-ranging species which occurs from eastern Siberia, Manchuria and northern China to Korea and Japan. This is one of the most vigorous of all members of the group; in the native state it is said to climb to the top of tall trees (Bean. 1940, p. 30) and relatively young plants at the Arboretum have produced an amazingly dense growth on a cyclone fence around the farm nursery (See cover).

The leaf-blades of this plant have the same general size and shape as those of *A. Kolomikta,* but are abruptly acuminate at the apex (See Fig. 19), and the lustrous green leaf-surfaces contrast strikingly with the bright red color of the petioles. Here, again, there is frequently a pronounced difference between the leaves of the male and female plants.

The whitish corollas of this species are slightly tinged with green and the numerous stamens are purplish, whereas those of the two preceding species are yellow or orange. *A. arguta* is strictly dioecious and in the picture shown on the cover the plant on the left is male while that on the right is female.

The smooth oblong fruit of *A. arguta* is about one inch in length (See Fig. 20), greenish-purple when mature and rather pleasantly sweet. Our carpellate plant fruited copiously in the autumn of 1956 and the members of the staff who sampled them likened them to figs. Fairchild (1947. p. 203) records a similar impression and Wyman (1949. p. 367) states that preserves have been made from the fruit.

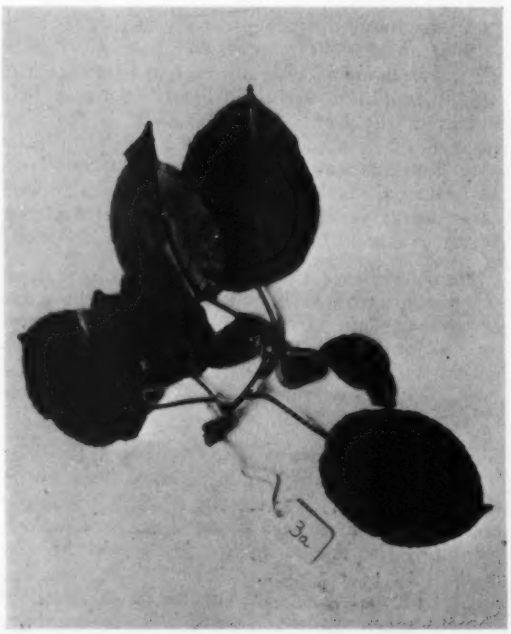

Fig. 20. *A. arguta.* Leaves and fruit of female plant.

The three Actinidias described above are interesting subjects and should be more widely grown. The vigorous habit of *A. chinensis* and *A. arguta* recommends them for any situation where a quick dense screen is desired. They lend themselves well to growing on a fence, an arbor, a bank or an unsightly stone pile. The flowers of all, while not spectacular, are interesting and attractive, and the fruits, as already indicated, are not without merit.

It is hoped that several other species which are known to be hardy, such as *A. polygama*, *A. rubricaulis* and *A. melanandra*, will soon be added to our collection so that visitors may have an opportunity of becoming acquainted with them.

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The Origin and History of the Cultivated Plane-trees

HUI-LIN LI

(Continued from Page 9)

ORIGIN OF THE LONDON PLANE

The London Plane apparently first appeared in cultivation in the 17th century. Various opinions were expressed regarding its origin and there were attempts to trace it to some Asiatic sources. While it was first generally regarded as a variety of the Oriental Plane, from the very beginning suggestions of its hybrid nature appeared from time to time in the literature.

Henry made a thorough study of this problem (1908). At first he rejected the hybrid origin of *P.* × *acerifolia*, but his subsequent investigations (1919) led him to believe firmly in the hybrid origin of the London Plane. Such is the view now generally accepted. Henry is of the opinion that the remarkable vigor of the London Plane, its power of resistance to drought, smoke and other unfavorable conditions of soil and atmosphere, is due to its hybrid origin.

Henry believes that the London Plane must have originated as a chance seedling in some botanic garden, where an American Plane and an Oriental Plane happened to grow close together. His historical research led him to surmise it was possibly originated in the Oxford Botanic Garden at about 1670.

Henry's surmise was based on the following: The American Plane was introduced from America to England by Tradescant in 1636, while the Oriental Plane arrived about a century earlier. By 1670, the American species would be old enough to bear pollen. There is a manuscript left by Jacob Bobart, Jr., curator of the Botanic Garden at Oxford in 1680, which is without date, although a similar one bears the date 1666. In the enumeration of Planes in cultivation, besides *P. orientalis* and *P. occidentalis*, a plant is listed as "P. inter orientalem et occidentalem media", and corresponding to this diagnosis of a "Plane intermediate between the Oriental and American species", there is a herbarium specimen, undoubtedly *P.* × *acerifolia*, in the Sherard Herbarium at Oxford, labeled "Platanus media". Specimens labeled "Platanus media, n.d. Bobart, Ox." are in the British Museum, made at about the same period, together with the type specimen of the first published description of the London Plane by Plukenet in 1700.

Thus, it is the opinion of Henry that the original tree which Plukenet describes as bearing large fruit balls in 1700, was then living in the Oxford Botanic Garden, and as it may have been then thirty years old, this would give the date of origin of *P.* × *acerifolia* as 1670.

Henry's surmise, which as he says is something which cannot be definitely proved, may not be far from the truth. It gives, however, only the earliest historic records of the tree, and does not necessarily mean that subsequent trees of the London Plane are all derived from this single individual, as implied by Henry.

Henry, moreover, points out earlier (1908) that the *P. occidentalis* of Evelyn's Sylva, ed Hunter 1683, is undoubtedly *P.* × *acerifolia*. This shows that there might possibly be more than a single source of origin even at this early date.

A point against Henry's assertion that *P.* × *acerifolia* originated in England is the fact that *P. occidentalis* does not live long enough to flower in England and that there is no record that

the tree ever flowered there in former times (Bean 1919). Although the earliest record of *P.* × *acerifolia* is from English sources, nevertheless, it is quite possible that actually it might have originated concurrently or exclusively on the European continent where both *P. occidentalis* and *P. orientalis* are hardy.

The first record of the London Plane on the continent was made by Tournefort in 1703 as "P. orientalis aceris folio". Since then the cultivation of this tree has spread all over the continent.

An early opinion on the origin of this plant was expressed by Miller (1731) who says of *P.* × *acerifolia*, "Although by some supposed to be a distinct species from either *P. orientalis* or *P. occidentalis*, it is no more than a seminal variety of the first; for I have had many plants that come up from seeds of the first sort which ripened in the Physick Garden (Chelsa), which do most of them degenerate to this third sort; which, in the manner of its leaves, seems to be different from either, and might reasonably be supposed a distinct kind by those who have not traced its original".

The current scientific name of the plant is adopted from the one given by Aiton in 1789, who considers it as a variety of the Oriental Plane as *P. orientalis acerifolia* (in Hort. Kew. 3: 304. 1789). Willdenow is the first to accord it specific status as *P. acerifolia* (Ait.) Willdenow (in Linn. Sp. Pl. ed. 4, 1: 474. 1805), but, in spite of this, most authors, up to the beginning of the current century, treated it as a variety of *P. orientalis*.

The London Plane is a tall tree with an upright stem, attaining to a size intermediate between the taller *P. occidentalis* and the slightly lower *P. orientalis*. The bark usually exfoliates in large flakes as in *P. orientalis* and the inner bark is variable in color. The leaves are large, with fine broad triangular lobes resembling more closely those of *P. occidentalis* but in general the middle lobe is slightly narrower. The lobe is about as long as broad while in *P. occidentalis*, the middle lobe is broader than long. The fruiting heads are extremely variable in size and number on the peduncle; mostly in twos, but varying to as many as six. The individual achenes are similar in structure to those of *P. orientalis* and do not resemble those of *P. occidentalis*.

It can thus be seen that *P.* × *acerifolia* resembles *P. occidentalis* more closely in foliage characters and *P. orientalis* in fruiting structures. Because of the close similarity of the leaves between *P. occidentalis* and *P. orientalis*, the two were much confused with each other in the literature of the 18th and 19th centuries. Inasmuch as *P. occidentalis* is quite unsuitable to the climate in England and Europe, it must have been very rare in these countries in former times (as at the present) and plants referred to as *P. occidentalis* were actually invariably *P.* × *acerifolia*. Not until 1856 did Hooker (1856) clarify the confusion by distinguishing the two on the basis of fruiting characters, which had hitherto been unnoticed.

The hybrid nature of the plant, although not definitely recognized at first, was long suspected by many authors. A horticultural name, *P. intermedia* Hort., of unknown origin but expressing the apparent hybrid nature of the plant, long appeared in the synonymy of *P.* × *acerifolia*. It is listed under *P. orientalis* var. *acerifolia* Ait. by Loudon in 1844,[4] and might have been in existence much earlier.

That the hybridization did not occur in one instance only is indicated by the independent recognition of this phenomenon in several other countries. Before 1731, there was known in England a plant called the Spanish Plane-tree which is essentially similar to *P.* × *acerifolia* but with wider leaves having more cordate bases. The tree, described in Miller's Dictionary, ed. 7, published in 1759, is based on one he planted in 1731 as a variety accidently arisen from seed. His description is unmistakably that of the Spanish Plane later known as *P. hispanica*. This rare tree, which originated some time before 1731, was, in the opinion of Henry, probably a seedling of one of the early London Planes. The same tree was imported to England from France in 1856 under the name *P. macrophylla* (Rivers 1860).

In 1804, Brotero, Fl. Lusitan. 2: 487. 1804, describes *P. hybridus* from plants cultivated in Portugal. Although this is generally but doubtfully referred to the synonymy of *P. occidentalis*, there is a strong indication that it should be considered as a synonym of *P.* × *acerifolia*, which has actually a year's priority over the latter name.

These various records seem to indicate that hybrids between *P. occidentalis* and *P. orientalis* appear to have arisen independently in several different countries at different times. It may be argued that the Portuguese and Spanish plants were introduced from England, but inasmuch as they are quite distinct from the English types, this seems rather unlikely. On the contrary, the Spanish plant, which was called Spanish Plane in England as early as 1759 or earlier, must have come from Spain rather than the reverse. Furthermore, *P. occidentalis* is known to be tender in England, seldom reaching the adult fruiting

[4]This antedates Rehder's assertion (Rehder 1949) that the name, in synonymy, is to be credited to the Kew Handlist of Trees and Shrubs of 1896. Still less understandable is the listing of this name by Index Kewensis Suppl. 9, 1938, attributing this name, also in synonymy, to Chow, Familiar Trees of Hopei, 1934. This latter work follows essentially the nomenclature as given in the first edition of Rehder's Manual of 1927.

stage there, but is more at home in southern Europe. In the latter area hybrids between it and *P. orientalis,* which is also more commonly planted there than in England, are more likely to occur than in any region further north.

The Spanish Plane, also known as *P. macrophylla* as illustrated and described by Bean (1919) from trees grown in England, shows more distinctly the influence of *P. occidentalis* in its fruiting characters than other plants of *P.* × *acerifolia.* The fruiting heads, occasionally 2 or 3 together, are frequently solitary, with the individual achenes almost smooth and more flattened at the apex than those of *P. orientalis.*

Variations of the London Plane

From the records, it seems therefore justifiable to conclude that *P.* × *acerifolia* or the London Plane is an assorted group of trees of variable characters which have originated as hybrids between *P. orientalis* and *P. occidentalis* independently in different countries in eastern Europe and the British Isles at various times. Since the two species hybridize, it is very unlikely that hybridization happened only once and not in other localities, especially where more individual trees of both species are present. The two parent species concerned are very variable in their characters. This explains the occurrence of the many different types of hybrid progenies derived from these two species. These progenies, whether propagated vegetatively or as seedlings, maintain or further increase the variation of the complex known collectively as *P.* × *acerifolia.*

Among the cultivated specimens of *P. orientalis* in Europe, there are usually recognized two varieties, *cuneata* and *digitata.* Although their leaves resemble more closely *P. orientalis,* Henry is apparently right, in view of their frequently imperfect achenes, in considering them as of hybrid origin. Henry believes them to be second generation seedlings of *P.* × *acerifolia.* Although we have no way of ascertaining their origins, they are possibly cultivated clones of advanced generation segregates of the hybrid *P.* × *acerifolia* that resemble most closely *P. orientalis* in leaf shape.

Henry (1919) recognizes *P.* × *acerifolia* as the first generation hybrid of *P. orientalis* and *P. occidentalis* and accepts six additional "species" as second generation hybrids, including *cuneata* and *digitata,* mentioned above, and two new species of his own as follows:

P. hispanica Muenchhausen
P. pyramidalis Rivers
P. cuneata Willdenow
P. digitata Gordon
P. cantabrigiensis Henry
P. parviloba Henry

According to modern taxonomic concepts and nomenclatural practices, since *P.* × *acerifolia* is considered as a hybrid between *P. orientalis* and *P. occidentalis,* it should be designated either by the formula *P. orientalis* × *occidentalis* or by the name *P.* × *acerifolia.* Only one specific epithet is admissible in this case, and such other specific names as given by Henry, if considered as of hybrid origin between the two same parental species, should all be included in this concept. Variations within *P.* × *acerifolia* should be recognized as cultivars (cv.) and rendered in Roman in quotes instead of using italicized Latin names. Such cultivars as are propagated solely by vegetative means from a single known stock are known as clones (cl.). The recognized variations of *P.* × *acerifolia* (Henry & Flood 1919, Rehder 1940) are described and discussed below.

(1) *P.* × *acerifolia* cv. 'hispanica'

Leaves large, often 30 cm. in width, persistently tomentose on the nerves and petioles, shallowly cordate or cuneate at base, with 5 distinct short, broadly triangular lobes, the margins dentate. Heads not so flattened as in *P. occidentalis* and not so conical as in *P. orientalis.*

This taxon appeared formerly also under the names, *P.* × *acerifolia* var. *hispanica, P. hispanica,* or *P. macrophylla.* It is cultivated in England and France, but is apparently unknown in America. It is a vigorous tree, which, according to Henry, produces good seeds from which seedlings, which are not uniform, can be easily raised; however, in nurseries it is invariably propagated by cuttings.

(2) *P.* × *acerifolia* cv. 'cuneata'

Small tree. Leaves deeply 5-lobed, very cuneate at base, conspicuously dentate at the margins, practically glabrous when adult. Fruiting heads 2-4, small, rarely over 2 cm. in diameter, composed of few, often imperfect achenes.

This is a variety long placed in *P. orientalis,* as young trees of cultivated *P. orientalis* and even certain adult wild forms often bear cuneate leaves and are scarcely distinguishable. But Henry points out that this variation is distinguished by its fruiting heads, which are small and often made up of few mostly imperfect achenes and for this reason he believes it to be probably of hybrid origin. It conceivably originated sometime before 1789, when it was first made known by Aiton.

(3) *P.* × *acerifolia* cl. 'digitata'

Leaves resembling *P. orientalis* but much smaller, to 13 cm. broad, the base truncate but with a short central cuneate part, the lobes 5, elongated, dentate, with wide sinuses. Fruiting heads 2-3, very small, about 1.2 cm. in diameter,

composed of a few imperfect achenes.

Henry is probably right in suggesting this as originated from a seedling of *P.* × *acerifolia,* and not a variety of *P. orientalis,* as designated by most authors. According to him, it is rare in cultivation, and only two trees are known, both in England.

(4) *P.* × *acerifolia* cl. 'pyramidalis'

Of upright habit, the lower branches widespread but not drooping when old. Leaves truncate, usually 3-lobed, the lobes broadly triangular, slightly dentate.

This clone was probably originated in France about 1850. It is now much planted in England as a street tree.

(5) *P.* × *acerifolia* cl. 'Kelseyana'

Leaves spotted in the center with yellow, the margins green. Known also as *P.* × *acerifolia* var. *aureo-variegata.*

(6) *P.* × *acerifolia* cl. 'Suttneri'

Leaves large, white over most of the surface but with green spots in the center.

(7) *P.* × *acerifolia* cl. 'cantabrigiensis'

Leaves rather small, to 13 cm. wide, the base truncate with a cuneate central part, 5-lobed, the lobes distinct, short, triangular, entire or with 1 or 2 teeth. Fruiting heads 3, small, about 2 cm. across, of few imperfect achenes.

A single tree of unknown origin in the Cambridge Botanic Garden, described by Henry as *P. cantabrigiensis.*

(8) *P.* × *acerifolia* cl. 'parviloba'

Leaves variable, truncate to cuneate, with 3 triangular or oblong-triangular slightly dentate or entire lobes and 2 additional small lobes or teeth near the base. Fruiting heads 3-6, small, about 2 cm. across, made up of a few achenes, some imperfect.

A single grafted tree at Kew of unknown origin; described by Henry as *P. parviloba.*

The London Plane in America

The London Plane, as well as the Oriental Plane, must have been introduced into America from Europe during colonial times, although records of its early introduction do not seem to exist. As mentioned above, the London Plane and the Oriental Plane were often not distinguished in the horticultural literature of the 19th century and earlier, and what was mentioned as the Oriental Plane was in all cases the London Plane. The confusion between the two seems to persist up to the present, especially in the trade, while in Europe, the London Plane was formerly much confused with the American Plane.

In Philadelphia, there is a generally circulated notion that William Harper, who presumably raising them from seed, first introduced the London Plane into this country about fifty years ago. A published record of this is found in R. H. True's report of Jackson's lecture on the diseases of the Plane-tree in 1936 (True 1936), "It was reported by Mr. S. N. Baxter, City Arboriculturist of Philadelphia, in the discussion following the lecture, that this type of Plane tree [London Plane] was introduced into Philadelphia about thirty years ago by Mr. William Warner Harper, of Andorra Nurseries." Mr. Harper is apparently the first one who introduced this tree on a large scale, but earlier than this the London Plane must already have been in existence in this country, especially around Philadelphia, as there are references to it, for instance, in Meehan's Monthly in the late nineteenth century. The tree was then usually known as the "Oriental Plane." Incidentally, at Andorra Nurseries, the London Plane is today still called"Oriental Plane" and since they propagate it solely by cuttings, their present nursery stock may be the direct descendants of the early trees introduced by Harper from London some fifty years ago.

In North America, the Oriental Plane is not hardy in the north, but the London Plane is hardy as far north as southern New Hampshire. As noted above, the true Oriental Plane occurs rarely if at all in cultivation anywhere in North America, and trees bearing this name are nearly all referable to the London Plane. Actually nearly all the Plane-trees extensively planted along the streets throughout the country are London Plane, as the native American Plane, because of its susceptibility to fungus disease, is not satisfactory for this purpose.

The London Plane, as cultivated in this country, appears to be extremely variable. In and around Philadelphia, observations made on numerous trees in parks and along streets show that marked variations are readily discernible in the color of bark, shape of leaves and number and size of fruiting heads. The inner bark varies in color from brownish to silvery grayish and the outer bark peals off in patches of different sizes and in different degrees, although more often it peels off in relatively larger patches. The leaves are exceedingly variable in size and shape, including the base, the number, size and shape of lobes, the serrations, and the hairiness. The fruiting heads are mostly in twos, but the number varies from one to three and occasionally more.

The general shape of the leaves of the London Plane in America, however, seems to differ from those in Europe, especially in older trees. The lobes of the American trees are broad and short, and while they are slightly longer than those of the American Plane, *P. occidentalis,* they are much shorter and broader than those of *P. orientalis.* The sinuses are broad and shallow. (Fig. 5) In the older trees in Europe, for instance, the London Plane tree near the Rue Jussieu en-

trance of the Jardin des Plantes, Paris, and a tree at Kew, the leaves are deeply and narrowly lobed, approaching very closely the condition in *P. orientalis*. The Paris tree bears the label "Platanus × acerifolia, orientalis × occidentalis, connu depuis 1670. Un des 3 pieds plantés par Buffon entre 1784 et 1788". These trees bear leaves resembling very closely the few supposed specimens of *P. orientalis* of Philadelphia and New York and for this reason it is suggested that these American trees may also be segregates of hybrids between *P. orientalis* and *P. occidentalis*. Like the other London Planes they happen to be extremes more closely resembling one of the two parents and are not true or pure *P. orientalis*.

It is, however, entirely clear that the London Planes now planted in America are significantly different from the London Plane-trees in Europe, especially those planted one or two hundred years ago. The trees in Europe show strong affiliation with *P. orientalis*, as manifested particularly in the shape of the leaves. The plants generally grown in America show more closely and strongly characters of *P. occidentalis*. While a more definite solution to this problem requires detailed analysis of specimens in quantities, our observation so far points out that most of the London Planes in America are probably not first generation hybrids of *P. orientalis* and *P. occidentalis*, but are raised from hybrids of these species, back-crossed, perhaps successively for more than one generation, to the native American *P. occidentalis*.

The importance of London Plane to modern cities can hardly be over-emphasized. As mentioned before, out of 158,000 trees planted along the sidewalks of Philadelphia, nearly one-third are London Plane. In New York City, 2,282,000 trees are under the care of the Park Department, a large proportion being London Planes, especially in Manhattan, where the London Plane, numbering 47,000, forms the bulk of the tree population. (New York Times, Aug. 26, 1955)

London Plane originated and spread under man's tutelage less than three hundred years ago. Its dramatic use by man parallels the rapid development and expansion of modern cities, including New York and Philadelphia, within the same age. The mutual dependence of London Plane and modern city dwellers constitutes an important and interesting chapter in anthropological chronicles. Many modern urbanites are not aware of the fact that as their forefathers removed the natural vegetation of the land to create cities, it was largely the London Plane that took the place of forest trees. These trees of the city streets not only shade their abodes and beautify their surroundings but also remind them of the changing seasons of the year and purify the very air they breathe.

Common Names of Plane-trees

Confusion in the status of cultivated Plane-trees can be attributed in part to the numerous common names applied or misapplied to these plants, which in turn, reflect their variable nature and puzzling origins.

The name "Plane" derives from the scientific name *Platanus* adopted from the classical name derived from the Greek *platys*, meaning ample, in allusion, according to most authors, to its spreading branches and shady foliage. Fernald (1950), however, says that *platys, broad*, apparently refers to the large leaves. It is known as Platanus in German and Platane in French. In America, the common name of the different Plane-trees is Sycamore but in Europe this name is always applied to *Acer pseudo-platanus* and never to the Plane. In Scotland the name Plane-tree is also applied to *Acer pseudo-platanus*. Actually Sycomorous of the ancients is the *Ficus Sycomorous* of northeastern Africa.

Oriental Plane is the name generally applied to *P. orientalis* in England and America, although in the literature it is occasionally also known as Eastern Plane. It is called Morgenlandischer Platanus in German and Platane de l'Orient in French and is known to the Persians as Chinar and to the Arabs as Doolb. (Loudon, 1844)

The American Plane, *P. occidentalis*, is also known in the horticultural literature of England as the Occidental Plane or the Western Plane. In America, besides being called Sycamore, it is commonly known also as Buttonwood, and sometimes by such less common names as Cotton Tree, Water Beech or Button-ball Tree.

The London Plane and its variations have acquired a long list of names in less than 300 years since their first appearance. In the literature, the following names, most of them no longer in use, are recorded: Park Plane, Spanish Plane, London Plane, Sycamore, Maple-leaved Plane, European Plane, Oriental Plane and Eastern Plane. The last two names were applied to the London Plane in earlier literature, when it was generally considered as a variety of *P. orientalis*, and this indiscriminate use, as mentioned before, is a main source of confusion of the two Plane-trees in subsequent years, in both the trade and in horticultural literature, down to the present.

Acknowledgments

The author is indebted to the curators of the herbaria of the Academy of Natural Sciences of Philadelphia, the Arnold Arboretum, the New York Botanical Garden, and the Smithsonian Institution for loan of specimens or permission to consult their collections. He also wishes to express his thanks to Drs. E. J. Schreiner and H. T.

Skinner for helpful suggestions and to Dr. J. M. Fogg, Jr. for reading the manuscript and offering valuable criticisms.

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Trees and Soil Reaction

Edgar T. Wherry

Pennsylvania-German naturalists have a tradition that their ancestors, on coming to this country and being given a choice of areas to occupy, passed up those forested chiefly by oak and pine and selected those where such trees as elm, linden, and walnut were prominent. Experience in their native land had shown them that trees of these genera were indicators of especially desirable agricultural soils; and so it turned out. They occupied and cultivated with marked success the strip of limestone land curving across the southeast corner of this state from the present Northampton to York counties. Soils derived from limestone are relatively high in nutrient elements and circumneutral in reaction, whereas those formed from shale, sandstone, granite, etc., tend to be lower in nutrients and more or less acid. These contrasted sorts of soils favor the growth of dissimilar groups of trees.

Conifers

For the most part our coniferous trees thrive best in the more acid, nutrient-poor soils, although (as usual) there are a few notable exceptions. American Arbor-vitae or Northern White Cedar *(Thuja occidentalis)* flourishes in the limy swamps of Canada and the northern United States, and attains great age and size on the limestone of the Shenandoah Valley, notably around Natural Bridge, Virginia. Red Cedar *(Juniperus virginiana)* reaches its maximum development in the limestone glades of Tennessee, while in land underlain by dominantly siliceous rocks it tends to occupy spots where local conditions keep the acidity down. Yellow or Shortleaf Pine *(Pinus echinata)* and Virginia or Scrub Pine *(P. virginiana)* are lime-tolerant, and are conspicuous in the above-noted Shenandoah Valley. Hemlock *(Tsuga canadensis)* while most frequent on decidedly acid soils, can occasionally grow on limestone cliffs if these are especially steep and bleak.

Catkin-bearers (Amentiferae)

Members of two families in this group, — elms and walnuts — were mentioned in the opening paragraph as indicators of nutrient-rich soils. Most of their relatives, like hickories and mulberries, also thrive in such situations. In contrast, the majority of the members of the Birch and Oak Families are better adapted to acid, nutrient-poor soils. They flourish over sandstone and granite, and manage to survive on limestone only where this outcrops on steep, dry, slopes. Again there are exceptions: Shingle Oak *(Quercus imbricaria)*, Overcup Oak *(Q. macrocarpa)* and Yellow Oak *(Q. Muhlenbergii)* are, in regions of moist climate, limestone indicators, while White Oak *(Q. alba)*, and Post Oak *(Q. stellata)* are de-

cidedly lime-tolerant, and able to grow well in both acid and circumneutral soils.

A Dozen More Tree-including Families

Among the Magnolias, only one native, Sweet Bay *(M. virginiana)* requires strongly acid soil. Sassafras, Sweet-gum, and Sycamore do best in loamy soil where the acidity is moderate but nutrients are abundantly available. Many of the members of the Rose Family thrive on limy, nutrient-rich soil; American Mountain-ash *(Sorbus americana)* is an exception, requiring acidity. The root-nodule bacteria which help nourish trees of the Legume Family are favored by circumneutral reactions, although the Black Locust *(Robinia pseudo-acacia)* is tolerant of high acidity. Our prickly Holly *(Ilex opaca)* favors mild acidity, and is poisoned by abundant lime. Ash-leaved Maple *(Acer Negundo)*, Silver Maple *(A. saccharinum)* and Sugar Maple *(A. saccharum)* are plants of nutrient-rich soils, while Red Maple *(A. rubrum)* shows as wide a range of tolerance as any of our trees. Linden *(Tilia americana)* favors mineral-rich soils, while White Ash *(Fraxinus americana)* seems indifferent to soil chemistry. Sour Gum *(Nyssa sylvatica)* and White Dogwood *(Cornus florida)* belong to the moderately acid group, and rarely thrive on limestone.

The Michaux Quercetum

Several years ago the American Philosophical Society sponsored the assembling of a living collection of oaks, in honor of the pioneer worker on these trees in America, Francois André Michaux. Under the auspices of the Morris Arboretum, acorns of numerous species from many parts of this country, and some from abroad, were sent in by foresters, botanists and naturalists, accompanied by full authenticating data. These were duly planted, grown for a couple of years, and their species identity checked.

When the time came to set these out, however, a problem arose. As shown on the map published in the first of my essays on soil reaction in this Bulletin,[1] the northern third of the tract is underlain by limestone; and as its surface is relatively flat, mineral-rich, circumneutral soils have accumulated there. Here was the only space available for planting oaks; yet only one fourth of the species, at most, could be expected to reach maturity there.

To quote Lutz:[2] "From time to time, foresters have attempted to develop artificial associations of trees which have no known counterpart in nature. Trees have been moved outside their natural ranges and habitats and confronted with environmental conditions . . . that they have never previously experienced in their evolutionary development. Many, if not most, of these attempts have led to unhappy results. Diseases, arising from both insects and fungi, appear to be more prevalent in artificial associations than in natural ones, and their damage is often more serious."

In the present case, while seedlings of the oaks obtained were planted out on the limestone plateau, three fourths of them can be expected to become chlorotic and to fall prey to diseases in a relatively few years. Fortunately for the project, the Longwood Foundation came to the rescue. Their land, largely subacid, low-nutrient loam over schistose rocks, is well suited to the growth of the majority of our oaks. So it is there that future botanists can observe the development of the real Michaux Quercetum.

[1] Vol. 6. 38. 1956.
[2] Ecology, vol. 38, p. 47, 1957.

New Chromosome Counts in *Acer* and *Fraxinus*

JONATHAN W. WRIGHT[1]

The basic chromosome numbers in *Acer* (x = 13) and *Fraxinus* (x = 23) are known from studies made by previous workers.[2] However, there are many species in these genera for which counts have not yet been made.

Counts for several of these species are here reported for the first time. They were made from tissues that were fixed in acetic-alcohol, stained in acetic-orcein, and made into temporary smear preparations according to the recommendations of La Cour.[3] The haploid counts were made from pollen mother cells. The diploid counts were made from leaf smears (older trees) or root tips (seedlings). The material was collected from old trees in the Morris Arboretum and in the Haverford College Arboretum, Haverford, Pa., and from seedlings raised in the Morris Arboretum greenhouse.[4]

The chromosomes in these genera are small — 1 to 3 microns long in *Fraxinus*, and 2 to 5 microns long in *Acer*. For that reason the making of karyograms was not attempted. The counts made are as follows:

ACER

A. Buergerianum Miq. Trident maple. Tree M-1676.[5] n = 13.

A. cappadocicum Gleditsch. Coliseum maple. Tree M-1649. 2n = 26.

A. Henryi Pax. Tree M-1373. n = 13.

A. macrophyllum Pursh. Oregon maple. Seedling NEG-496[5] of Vancouver, B. C. provenance. 2n = 26.

A. Mayrii Schwerin. Tree M-57-139. 2n = 26.

A. Negundo L. Box-elder. Tree M-57-140. n = 13. (Confirmation of previous count.)

A. platanoides L. Norway maple. Tree M-57-141. 2n =-26. (Previously reported as 2n = 26, 2n = 39.)

These chromosome counts bring the number of maple species for which the chromosome number is known to 29. Of these, 24 are diploid, with 2n = 26 chromosomes: *A. argutum* Maxim., *A. Buergerianum* Miq., *A. campestre* L., *A. cappadocicum* Gleditsch, *A. circinatum* Pursh., *A. cissifolium* K. Koch, *A. crataegifolium* Sieb. and Zucc., *A. diabolicum* K. Koch, *A. ginnala* Maxim., *A. griseum* Pax, *A. Henryi* Pax, *A. japonicum* Thunb., *A. macrophyllum* Pursh., *A. manshuricum* Maxim., *A. Mayrii* Schwerin, *A. Miyabei* Maxim., *A. mono* Maxim., *A. Negundo* L., *A. nikoense* Maxim., *A. palmatum* Thunb., *A. pseudosieboldianum* Komar., *A. rufinerve* Sieb. and Zucc., *A. saccharum* Marsh., and *A. tschonoskii* Maxim.

The remaining species are diploid or triploid (*A. platanoides* L. 2n = 26 or 39); tetraploid (*A. carpinifolium* Sieb. and Zucc., *A. pseudoplatanus* L., and *A. saccharinum* L. 2n = 52); or hexaploid and octoploid (*A. rubrum* L. 2n = 78, 104). The five polyploid species are more widespread and aggressive than is the average maple species.

FRAXINUS

F. americana L. White ash. Counts of 2n = 46 were made on seedlings of the following provenances: Montgomery County, Penna. (NEG-393); Berkshire County, Mass. (NEG-400); Decatur County, Ind. (NEG-788); Marion County, Ind. (NEG-789, -797); Ripley County, Ind. (NEG-799); and Anderson County, Tenn. (NEG-811). Counts of 2n = approximately 92 were made for seedlings of the following provenances; Montgomery County, Penna. (NEG-391, -392); Pope County, Ark. (NEG-773); and Decatur County, Ind. (NEG-785). (Previous counts of 2n = 46, 92, and 138 were reported for this species.)

F. anomala S. Wats. Single-leaf ash. Seedling NEG-387 of Delta County, Colo. provenance. 2n = 46.

F. Bungeana D. C. Tree G-1314.[5] n = 23. (Confirmation of previous count.)

F. chinensis Roxb. Chinese ash. Seedling of tree M-57-142. 2n = 92. (Previously reported as 2n = 138.)

F. latifolia Benth. (= *F. oregona* Nutt.) Oregon ash. Counts were made on seedlings of the following provenances: Washington County, Ore. (NEG-388) and Mendocino County, California (NEG-494). 2n = 46. (Confirmation of previous count.)

[1]Geneticist, Northeastern Forest Experiment Station, Upper Darby, Pa. The author is stationed at the Morris Arboretum, where the observations recorded in this paper were made, in cooperation with the University of Pennsylvania.

[2]Previous chromosome counts in these and other genera are to be found in Darlington, C. P. and Wylie, A. P. Chromosome atlas of flowering plants. 519 pp. Allen and Unwin, London. 1955.

[3]La Cour, L. F. Improvements in plant cytological technique II. Bot. Rev. 13: 216-240. 1947.

[4]Seed was sent in by G. S. Allen, S. B. Chase, F. E. Cunningham, J. W. Duffield, R. C. Friesner, P. H. Gerrard, A. G. Johnson, T. T. Munger, P. A. Munz, R. Nordine, J. F. Potzger, C. R. Towne, and by members of the staff of the Government Forest Experiment Station of Japan. Grateful acknowledgment is made to these collectors.

[5]M—numbers refer to numbers assigned by the Morris Arboretum. G— and NEG— numbers refer to numbers assigned by the Northeastern Forest Experiment Sattion.

F. longicuspis Sieb. and Zucc. Seedling NEG-915 of Nagano Prefecture, Japan provenance. 2n = 46.

F. nigra Marsh. Black ash. Tree G-1864. 2n = 46.

F. Ornus L. Flowering ash. Seedling of tree G-1882. 2n = 46. Confirmation of previous count.)

F. pubinervis Bl. Seedling NEG-912 of Akita Prefecture, Japan provenance. 2n = 46.

F. Spaethiana Lingelsh. Seedling NEG-913 of Akita Prefecture, Japan provenance. 2n = 46.

F. tomentosa Michx. f. Pumpkin ash. Seedling NEG-885 of Morton Arboretum, Chicago, Ill. specimen. 2n = approximately 138.

F. velutina Torr. Arizona ash. Counts were made on seedlings of the following provenances: Yavapai County, Ariz. (NEG-532, -533, -534, -535). 2n = 46. (Confirmation of previous counts.)

F. velutina var. *coriacea* (S. Wats.) Rehd. Seedling NEG-846 of Rancho Santa Ana Botanic Garden, Anaheim, Calif. specimen. 2n = 46. (Previously reported as 2n = 92.)

The chromosome numbers are now known for 20 species of *Fraxinus*. Of these, 16 are diploid, with 2n = 46 chromosomes: *F. angustifolia* Vahl., *F. anomala* S. Wats., *F. Berlandieriana* D. C., *F. Bungeana* D. C., *F. excelsior* L., *F. floribunda* Wall., *F. Griffithii* C. B. Clarke, *F. holotricha* Koehne, *F. latifolia* Benth., *F. longicuspis* Sieb. and Zucc., *F. nigra* Marsh., *F. Ornus* L., *F. pennsylvanica* Marsh., *F. pubinervis* Bl., *F. sogdiana* Bge., and *F. Spaethiana* Lingelsh.)

The remaining four species (*F. americana* L., 2n = 46, 92, and 138, *F. chinensis* Roxb., 2n = 92 and 138; *F. tomentosa* Michx. f., 2n = 138; *F. velutina* Torr., 2n = 46, 92) are polyploid or diploid and polyploid. The polyploid species or races are widely distributed geographically, and are more closely related to some diploid species or races than to each other. This indicates that polyploidy has been a secondary factor in the evolution of the genus.

Arboretum Activities

(Continued from Page 22)

Azalea Meadow – on the slope below the Gates Building – southward under the shadow of Oak Row and swinging it around so that it joins the plantings of Glen Dales referred to above. Eventually it is our intention to have this entire south-facing slope, with its several acres of open lawn, almost completely bordered with massed plantings of Rhododendrons and Azaleas, backed up by a foundation of *Leucothoe, Pieris* and conifers.

New plantings on the farm area, as previously mentioned in these notes, are being established in accordance with carefully prepared plans. During the fall and winter some 300 trees and shrubs have been set out, not including the oaks in the Michaux Quercetum, which was described in a recent issue.

In a low, moist area to the west of the entrance to this tract we are creating a swamp planting, using Swamp Cypress (*Taxodium distichum*) as a foundation, supplemented by such moisture-tolerant genera as elms, alders, willows, etc. The cypresses are already in place and other plants are being added as they become available.

In the drier sections which have been reserved for some of the large and important families considerable progress is being made and among the groups of which an appreciable representation may now be seen are: Rosaceae, Leguminosae, Aceraceae, Oleaceae, Styracaceae, and Caprifoliaceae.

Dr. Crane's Lecture

On Tuesday afternoon, March 12, a large group of our Associates and their friends attended a lecture by Dr. Eva Crane which was held in the Mansion. Dr. Crane, who is Director of the Bee Research Association of England, is on a tour of the important bee centers in this country, Cuba and Mexico. The title of her lecture was "From Cottage to Castle: Some Pictures of English Gardens."

In the evening Dr. Crane addressed a group of bee keepers, speaking on "Recent Advances in Bee Research." This session was presided over by Mr. Fred W. Schwoebel, Curator of the Arboretum's Langstroth Bee Garden.

Recreation Area

Again we call attention to the availability of our Recreation Area for organizations which desire to hold outings there. Although primarily reserved for groups from the campus, these grounds may be used by other organizations, who are asked to make appointments by calling the Office of the Dean of Men in Logan Hall, 36th and Woodland Avenue.

J. M. F., Jr.

LIBRARY ACCESSIONS

The following volumes have been added to the Arboretum Library during the past year:

Herbals, Agnes Arber (Cambridge Univ. Press, 1953)

China, Mother of Gardens, Ernest Henry Wilson (Stratford Co., Boston, 1929)

**Der Steinga Ten Und Feine Welt*, Wilhelm Schacht (Stuttgart, 1953)

**Blumenzwiebeln Fur Garten Und Heim*, Wilhelm Schacht (Stuttgart, 1955)

Azaleas and Camellias, Harold H. Hume (MacMillan, 1954)

Fauna and Flora of Nepal Himalaya, H. Kihara, Ed. (Kyoto Univ., Japan, 1955)

Garden Flowers in Color, Daniel J. Foley (Macmillan, 1952)

**The Present-Day Rock Garden*, Sampson Clay (London, 1937)

Families of Dicotyledons, Alfred Gundersen (Chronica Botanica Co., Waltham, Mass., 1950)

Our Northern Shrubs, Harriet L. Keeler (Scribners, 1903)

Our Native Trees, Harriet L. Keeler (Scribners, 1913)

A Guide to Home Landscaping, Donald J. Bushey (McGraw-Hill, 1956)

Color and Design for Every Garden, H. Stuart Ortloff and Henry B. Raymore (Barrows & Co., New York, 1954)

The New Book of Lilies, Jan de Graff (Barrows & Co., New York, 1952)

American Rose Annual 1956, Fred J. Nisket, Ed. (American Rose Society, 1956)

Plant Pathology, John C. Walker (McGraw-Hill, 1953)

The Gardener's A B C of Pest and Disease, A. W. Dimock (Barrows & Co., New York, 1953)

Garden Enemies, Cynthia Westcott (Van Nostrand, 1953)

Historia de las Plantas de Nueva España, Francisco Hernandez (Mexico, 1952)

Ground Cover Plants, Donald Wyman (Macmillan, 1956)

**Rock Garden and Alpine Plants*, Henry Correvon (Macmillan, 1930)

Botanische Tropenreise, G. Haberlandt (Leipzig, 1893)

A Naturalist in Western China, Ernest H. Wilson (London, 1913)

Outlines of the Geography of Plants, F. J. F. Meyen (London, 1846)

The Art of Growing Miniature Trees, Plants and Landscapes, Tatsuo Ishimoto (Crown Publishers, New York 1956)

Japanese Gardens, Matsunosuke Tatsui (Toyko, 1936)

Camellias in America, Harold H. Hume (J. Horace McFarland Co., Harrisburg, Pa., 1955)

Map of the Landforms of the U. S. (6th rev. ed. 1952)

**Wild Flowers in the Garden*, Walter E. Th. Ingwersen (London, 1951)

**The Wild Garden*, Margaret McKenny (Doubleday, Doran, 1936)

A Textbook of Pharmacognosy, N. M. Ferguson (Macmillan, 1956)

The Origin, Variation, Immunity and Breeding of Cultivated Plants, Vol. 13, 1949-50, N. I. Vavilov (Chronica Botanica, Waltham, Mass.)

**Western American Alpines*, Ira N. Gabrielson (Macmillan, 1932)

Diseases of Fruit Crops, Harry W. Anderson (McGraw-Hill, 1956)

Flora of Peru, James F. MacBride (Field Museum of Natural History, Chicago, 1936)

Plantae Yucatanae, Charles F. Millspaugh (Field Columbian Museum, Chicago, 1903)

Report on the Gums, Resins, Oleo-Resins, and Resinous Products in the India Museum or Produced in India, Mordecai C. Cooke (London, 1874)

Elementos de Botanica, Rudolph A. Philippi (Santiago de Chile, 1869)

The Root Endophytes of Some Javanese Plants, J. Janse. Translated by Kenneth D. Doak (Gift of Dr. Doak)

**A Manual of the Study of Insects*, John H. Comstock (Comstock Publishing Co., 1915)

The World Grows Round My Door, David Fairchild (Scribners, 1947)

Lilacs for America. Report of 1953 Lilac Survey Committee of American Assoc. of Botanical Gardens and Arboretums, 1953

An Enumeration of Plants in the Albury, Holbrook and Tumbarumba Districts of New South Wales, E. J. McBarron. Contributions from New South Wales National Herbarium, Vol. 2, No. 2, 1955

Chinese Flower Arrangement, Hui-Lin Li (Hedera House, Philadelphia, 1956), (Gift of Dr. Li)

Plant Diseases. The Yearbook of Agriculture (U.S.D.A., 1953)

Animal Diseases. The Yearbook of Agriculture (U.S.D.A., 1956)

Illustrations of Medical Botany, Joseph Carson (Lloyd P. Smith. Philadelphia, 1847)

The Identification of Trees and Shrubs, F. K. Makins (London, 1948)

**The American Flower Garden*, Neltje Blanchan (Doubleday, Page & Co., 1913)

The Indigenous Trees of the Uganda Protectorate, William J. Eggeling (London, 1951)

Flora of Bermuda, Nathaniel L. Britton (Scribner's, 1918)

Safety for Tree Workers, A. Robert Thompson. Tree Preservation Bulletin No. 2. Revised 1956.

Botanical Exploration of the Trans-Mississippi West, Susan D. McKelvey (Arnold Arboretum, 1955)

**North American Wild Flowers*, Mary V. Walcott. Vol. I-V (Smithsonian Institution, 1925)

**North American Pitcherplants*, Mary V. Walcott (Smithsonian Institution, 1935)

The Rhododendron and Camellia Year Book 1957 (Royal Hort. Soc., London)

**The Little Garden*, Mrs. Francis King (Atlantic Monthly Press, 1921)

**Adventures with Hardy Bulbs*, Louis B. Wilder (Macmillan, 1936)

A Flora of Manila, E. D. Merrill (Manila, 1952), (Gift of Phila. Commercial Museum)

Standardized Plant Names, H. P. Kelsey and W. A. Dayton (J. Horace McFarland Co., Harrisburg, Pa., 1942)

The New Flora and Silva, Vols. 1-11 (1929-1939) (Vol. 9 missing), E. H. M. Cox, Ed.

***Catalogue of the Vascular Plants of S. Tome*, Arthur W. Exell (London, 1944)

**Select Ferns and Lycopods: British and Exotic*, Benjamin S. Williams (London, 1873)

**My Garden*, Louise B. Wilder (Doubleday, Page & Co., 1920)

The Useful Plants of West Tropical Africa, J. Hutchinson and J. M. Dalziel (London, 1937)

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